

ELECTRODYNAMIC TETHER

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An introduction to Electrodynamic Tethers and the NASA program in this area is offered via an agenda of five topics:

- a. Tether Applications in Space (TAS) Program
- b. Mechanical Considerations on Tethered Satellite Systems
- c. What is an Electrodynamic Tether System?
- d. Ground Tests and Theoretical Studies
- e. Flight Demonstrations, Current and Planned

The purpose of the presentation was to introduce the program, players, and basic concepts to the noninitiated. Applications of the tether concept are rapidly growing in sophistication and complexity. An international program involving the governments of the United States and Italy is currently under way. A major experiment/demonstration, the Tethered Satellite System (TSS-1) is being built to demonstrate the following:

- a. Deployment and Control Dynamics
- b. Electrodynamic Power Generation

Other experiments planned, including a tethered wind tunnel to explore the more difficult to reach regions of the Earth's atmosphere.

Tethers hold promise for a variety of useful space applications. Electro-dynamic tethers depend upon the interactions between a moving insulated conductor and the Earth's magnetic field. An electric field is generated along the tether as in a conductor moving in the magnetic field of a generator. If the circuit is closed to the ambient space plasma via a plasma gun or other equivalent device, a current is enabled to flow in the tether, and electric power is generated at the expense of orbital mechanical energy. The net effect is a decrease in the altitude of the orbiting tethered system. The situation can be reversed by driving current against the electric field via an external power supply such as a photovoltaic array. In this case, the electrical energy delivered by the external supply is converted into orbital mechanical energy, the net effect being an increase in the altitude of the orbiting tethered system. Further details of this process and the means for closing the circuit to the ambient space plasma were presented.

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